

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

Mr. AOKI, Atsushi

**A. AOKI, ISHIDA &
ASSOCIATES, Toranomom 37
Mori Bldg., 5-1, Toranomom
3-chome, Minato-ku, Tokyo
1058423
Japan**

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing
(day/month/year)

11.1.2005

Applicant's or agent's file reference

P872-PCT

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/JP2004/014873

International filing date (day/month/year)

01.10.2004

Priority date (day/month/year)

02.10.2003

International Patent Classification (IPC) or both national classification and IPC

Int.Cl.⁷ **H01L33/00, H01S5/343**

Applicant

SHOWA DENKO K.K.

1. This opinion contains indications relating to the following items:



Box No. I

Basis of the opinion



Box No. II

Priority



Box No. III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability



Box No. IV

Lack of unity of invention



Box No. V

Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement



Box No. VI

Certain documents cited



Box No. VII

Certain defects in the international application



Box No. VIII

Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/JP

Japan Patent Office

3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan

Authorized officer

TOMOHISA TSUCHIYA

Telephone No. +81-3-3581-1101 Ext. 3253

2K

3412

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2004/014873

Box No. I

Basis of the opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2004/ 014873

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>4, 5, 7, 8, 12-18, 22-26, 30</u>	YES
	Claims	<u>1-3, 6, 9-11, 19-21, 27-29</u>	NO
Inventive step (IS)	Claims	<u>5, 7, 23-26</u>	YES
	Claims	<u>1-4, 6, 8-22, 27-30</u>	NO
Industrial applicability (IA)	Claims	<u>1-30</u>	YES
	Claims		NO

2. Citations and explanations

The following documents have been considered for the purpose of this report:

Document 1: JP 2002-043618 A
Document 2: JP 2003-229645 A
Document 3: JP 2001-102629 A
Document 4: JP 2002-133925 A

Each subject matter of Claims 1-3,6,9-11,19-21,27-29 does not meet the requirement of novelty.

Document 1(D1) discloses Multi Quantum Well(MQW) active layer comprising InGaN well layers and GaN barrier layers, wherein each barrier layer comprises a barrier sublayer A which has been grown during elevating the growth temperature from 750° C to 1050° C, and a barrier sublayer B which has been grown at the growth temperature of 1050° C. D1 also discloses a barrier sublayer which has been grown during lowering the growth temperature from 1050° C to 750° C(see D1[0058]).

Each subject matter of Claims 4,8 does not appear to involve an inventive step due to the above Document 1 cited in the International Search Report(ISR).

The skilled person in the art would easily conceive the idea of growing a barrier sublayer before elevating the growth temperature.

Each subject matter of Claims 12-18 does not appear to involve an inventive step due to the above Documents 1 to 3 cited in the ISR.

Document 2(D2) discloses barrier layers, wherein each barrier layer comprises a 2.5nm thick Si-doped InGaN sublayer having a Si concentration of $4 \times 10^{18}/\text{cm}^3$, and a 7.5nm thick undoped InGaN sublayer(see D2[0042]). Document 3(D3) discloses barrier layers, wherein each barrier layer comprises a 12nm thick undoped GaN sublayer, a 1nm thick Si-doped GaN sublayer having a Si concentration of $1 \times 10^{18}/\text{cm}^3$; and a 12nm thick undoped GaN sublayer(see D3[0033]). Therefore, the person skilled in the art would easily conceive the idea of applying the technical feature employed in D2 or D3 to the invention disclosed in D1.

Each subject matter of Claims 22,30 does not appear to involve an inventive step due to the above Documents 1 and 4 cited in the ISR.

Document 4(D4) discloses a nitride semiconductor light-emitting device covered with a cap containing a phosphor.

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

Claims 1-22,27-30 are not sufficiently supported by the description.

In lines 2-6, on page 14, it is described that effect of preventing lowering of reverse withstand voltage characteristics can be attained, so long as the growth temperature of the barrier sublayer C is higher than that of the barrier sublayer E. However, in Fig.6 and Comparative Example 2, it is described that reverse withstand voltage is considerably impaired, even though a barrier sublayer("a barrier sublayer D" in Comparative Example 2) is grown at the temperature lower than the barrier sublayer C.

Therefore, it is unclear that effect of preventing lowering of reverse withstand voltage characteristics can be attained when the sublayer E is grown not at a constant temperature but at a varying temperature.